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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/918,886	07/30/2001	Ting K. Yee	20852-05682	3294

758 7590 07/13/2005

FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

EXAMINER	
KIM, DAVID S	

ART UNIT	PAPER NUMBER
2633	

DATE MAILED: 07/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/918,886	YEE ET AL.	
	Examiner	Art Unit	
	David S. Kim	2633	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 December 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-60* is/are pending in the application.

4a) Of the above claim(s) *30-37 and 55-58* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10,11,14-29,38,39,42-54,59 and 60* is/are rejected.

7)☒ Claim(s) *9,12,13,40 and 41* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 July 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/19/02, 5/15/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: *IDS: 6/30/03, 12/6/04*.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of **Species I (claims 1-29, 38-54, and 59-60)** in the reply filed on 06 December 2004 is acknowledged. The traversal is on the ground(s) that new claims 59-60 are generic to more than one species, that is, Species I and II; Applicant thus requests withdrawal of the restriction requirement and examination of all pending claims 1-60. This is not found persuasive because the presence of generic claims does not obviate a restriction requirement involving **species**. Even if generic claims 59-60 were present in the original application, a restriction requirement would still be proper. See MPEP 809.02(a). Additionally, the previous Office Action (mailed on 03 November 2004) already made a provision for the consideration of additional species:

> "Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP §809.02(a)" (03 November 2004, p. 2).

The requirement is still deemed proper and is therefore made FINAL.

2. **Claim 30-37 and 55-58** are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being **no allowable generic or linking claim**. Applicant timely traversed the restriction (election) requirement in the reply filed on 06 December 2004.

Priority

3. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application); the disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

In this case, this instant application is a continuation-in-part of pending U.S. Patent Application Serial No. 09/728,373, "Optical Communications Using Heterodyne Detection," by Ting K. Yee and Peter

H. Chang, filed on November 28, 2000, which is a continuation-in-part of abandoned U.S. Patent Application Serial No. 09/474,659, "Optical Communications Using Heterodyne Detection," by Ting K. Yee and Peter H. Chang, filed on December 29, 1999. However, none of the disclosures of these parent applications are sufficient to comply with **the requirements of the first paragraph of 35 U.S.C. 112 for pending claims 1-60**. Therefore, this instant application does not receive the benefit of the earlier filing dates of these parent applications under 35 U.S.C. 120 for pending claims 1-60.

4. Applicant's claim for domestic priority under 35 U.S.C. 119(e) is acknowledged. However, the disclosure of the provisional application upon which priority is claimed and the disclosure of the instant application are not exactly the same. Thus, the provisional application may not provide adequate support under 35 U.S.C. 112 for **all** the claims of this application. ***Information Disclosure Statement***

5. The information disclosure statement filed on 19 February 2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but all the information referred to therein has not been considered. Examiner considered the information documents that were readily accessible, such as patents and journal documents that are available through online access. The other documents have not been considered; these documents are indicated by **a lack of Examiner's initials** next to the document listings. Should Applicant desire the consideration of these documents by Examiner, Applicant is advised to **send a legible copy** of each of these documents to the Office.

Drawings

6. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following features must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

In claim 5, "each optical transmitter comprises: an optical filter for selecting one optical sideband from the optical signal" is not shown.

In claims 7 and 24, "wherein the optical filter comprises: two Bragg filters coupled in series" is not shown.

In claim 13, "a second sinusoidal generator" and "frequency f2" are not shown.

7. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

8. **Claims 18, 47, and 49** are objected to because of the following informalities:

In claims 18 and 47, "the first optical signal..., each optical sideband containing the at least two subbands and tone" is used where -- the first optical signal..., each optical sideband containing the at least two subbands and tone *of the first optical signal* -- may be intended. Otherwise, antecedent basis is unclear. That is, "the at least two subbands and tone" may refer to the "second optical signal."

Also in claim 18 and 47, "the second optical signal..., each optical sideband containing the at least two subbands and tone" is used where -- the second optical signal..., each optical sideband containing the at least two subbands and tone *of the second optical signal* -- may be intended. Otherwise, antecedent basis is unclear. That is, "the at least two subbands and tone" may refer to the "first optical signal."

In claim 49, antecedent basis for "the pilot tone" is missing.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Bergano et al.

10. **Claims 1-2, 19, 38-39, and 59-60** are rejected under 35 U.S.C. 102(a) and (e) as being anticipated by Bergano et al. (U.S. Patent No. 6,134,033, hereinafter "Bergano").

Regarding claim 1, Bergano discloses:

An optical communications system comprising:

a transmitter subsystem (Fig. 3) comprising:

at least two optical transmitters (TRANS. #1, TRANS. #2), each for generating an optical signal containing a subband of information, each optical signal having a different polarization (Fig. 1); and

an optical combiner (315) coupled to the optical transmitters for optically combining the optical signals into a composite optical signal.

Regarding claim 2, Bergano discloses:

The optical communications system of claim 1 wherein the optical signals are orthogonally (Fig. 1) polarized.

Regarding claim 19, Bergano discloses:

The optical communications system of claim 1 further comprising:

a receiver subsystem (502 in Fig. 5) coupled to the transmitter subsystem by an optical fiber for recovering the subbands from the composite optical signal.

Regarding claim 38, claim 38 is a method claim that corresponds largely to the system claim 1. Therefore, the recited means in system claim 1 read on the corresponding steps in method claim 38. Claim 38 also includes limitations absent from claim 1. Bergano also discloses these limitations:

transmitting the composite optical signal across an optical fiber (500 in Fig. 5).

Regarding claim 39, claim 39 is a method claim that introduces limitations that correspond to the limitations introduced by system claim 2. Therefore, the recited means in system claim 2 read on the corresponding steps in method claims 39.

Regarding claim 59, Bergano discloses:

An optical communications system comprising a transmitter subsystem (Fig. 3) having one or more electrical input ports (e.g., ports to data modulator 485 in Fig. 4) for receiving one or more (Fig. 4 embodiment for each transmitter in Fig. 3) electrical signals containing information and an optical output port (optical signal 305 in Fig. 3) for transmitting an optical signal suitable for transmission across an optical fiber (500 in Fig. 5), the optical signal having at least two subbands (Fig. 1), each subband containing different information from the electrical signals and having different polarizations.

Regarding claim 60, claim 60 is a method claim that introduces limitations that correspond to the limitations introduced by system claim 59. Therefore, the recited means in system claim 59 read on the corresponding steps in method claim 60.

Kitayama

11. **Claims 1-3, 19-20, 38-39, 48, and 59-60** are rejected under 35 U.S.C. 102(b) as being anticipated by Kitayama ("Highly spectrum efficient OFDM/PDM wireless networks by using optical SSB modulation").

Regarding claim 1, Kitayama discloses:

An optical communications system comprising:

a transmitter subsystem (Fig. 3, p. 974, col. 2) comprising:

at least two optical transmitters (cwLD#1, cwLD#2), each for generating an optical signal containing a subband of information, each optical signal having a different polarization (Fig. 9); and

an optical combiner (3dB coupler) coupled to the optical transmitters for optically combining the optical signals into a composite optical signal.

Regarding claim 2, Kitayama discloses:

The optical communications system of claim 1 wherein the optical signals are orthogonally (Fig. 9, p. 974, col. 2, "mutually orthogonal") polarized.

Regarding claim 3, Kitayama discloses:

The optical communications system of claim 2 wherein:

each optical transmitter comprises:

an optical source (cwLD#1, cwLD#2) for producing an optical carrier; and

an electro-optic modulator (EOM#1, EOM#2) coupled to the optical source for modulating the optical carrier with the subband of information; and

at least one of the optical transmitters further comprises:

a polarization controller (PC) for making a polarization of the optical signal orthogonal to a polarization of the other optical signal.

Regarding claim 19, Kitayama discloses:

The optical communications system of claim 1 further comprising:

a receiver subsystem (portion after SMF in Fig. 3) coupled to the transmitter subsystem by an optical fiber (SMF) for recovering the subbands from the composite optical signal.

Regarding claim 20, Kitayama discloses:

The optical communications system of claim 19 wherein the receiver subsystem comprises:

a polarizing splitter module (p. 974, col. 2, "polarization beam splitter") for splitting the composite optical signal according to polarization; and

a plurality of heterodyne receivers (PD#1, PD#2) coupled to the polarizing splitter module for recovering the subbands.

Regarding claim 38, claim 38 is a method claim that corresponds largely to the system claim 1. Therefore, the recited means in system claim 1 read on the corresponding steps in method claim 38. Claim 38 also includes limitations absent from claim 1. Kitayama also discloses these limitations:

transmitting the composite optical signal across an optical fiber (SMF in Fig. 3).

Regarding claims 39 and 48, claims 39 and 48 are method claims that introduce limitations that correspond to the limitations introduced by system claims 2 and 20, respectively. Therefore, the recited means in system claims 2 and 20 read on the corresponding steps in method claims 39 and 48.

Regarding claim 59, Kitayama discloses:

An optical communications system comprising a transmitter subsystem (Fig. 3, p. 974, col. 2) having one or more electrical input ports (ports to EOMs) for receiving one or more electrical signals containing information and an optical output port (output of EDFA) for transmitting an optical signal suitable for transmission across an optical fiber (SMF), the optical signal having at least two subbands (Fig. 9), each subband containing different information from the electrical signals and having different polarizations.

Regarding claim 60, claim 60 is a method claim that introduces limitations that correspond to the limitations introduced by system claim 59. Therefore, the recited means in system claim 59 read on the corresponding steps in method claim 60.

Tsushima et al.

12. **Claims 22-23, 25-27, 29, 50, and 52** are rejected under 35 U.S.C. 102(b) as being anticipated by Tsushima et al. (U.S. Patent No. 5,305,134, hereinafter "Tsushima").

Regarding claim 22, Tsushima discloses:

An optical communications system comprising:

a transmitter subsystem (Fig. 1) comprising:

a first optical transmitter (transmitter 4(n-1)) for generating a first optical signal (ASK version, col. 4, l. 63-66) containing a lower optical sideband (e.g., lower half of band

ch.(n-1) in Fig. 5A) and an upper optical sideband (e.g., upper half of band ch.(n-1) in Fig. 5A);

a second optical transmitter (transmitter 4n) for generating a second optical signal (ASK version, col. 4, l. 63-66) containing a lower optical sideband (e.g., lower half of band ch.n in Fig. 5B) and an upper optical sideband (e.g., upper half of band ch.n in Fig. 5B);

an optical combiner (photocoupler 5) coupled to the optical transmitters for optically combining the first optical signal and the second optical signal; and

an optical filter (optical filter 6) coupled to the optical combiner for selecting the upper optical sideband of the first optical signal (optical filter 6 selects both sidebands of band ch.(n-1), including the upper optical sideband) and the lower optical sideband (filter 6 selects both sidebands of band ch.n, including the lower optical sideband) of the second optical signal to produce a composite optical signal (output from optical filter 6).

Regarding claim 23, Tsushima discloses:

The optical communications system of claim 22 wherein:

at least one of the optical transmitter comprises:

a wavelength-tunable optical source (e.g., DFB-LDs 4a in Fig. 10), whereby a wavelength of the optical signal generated by the optical transmitter can be tuned by tuning the wavelength-tunable optical source; and

the optical filter comprises:

a comb filter having periodically spaced pass bands (e.g., periodicity in Figs. 3B, 5, and 7).

Regarding claim 25, Tsushima discloses:

The optical communications system of claim 22 wherein the optical filter comprises:

a comb filter having periodically spaced pass bands (e.g., periodicity in Figs. 3B, 5, and 7).

Regarding claim 26, Tsushima discloses:

The optical communications system of claim 22 wherein the optical filter attenuates out-of-band wavelengths (optical filter 6 attenuates wavelengths that are out of the passbands).

Regarding claim 27, Tsushima discloses:

The optical communications system of claim 22 wherein the transmitter subsystem further comprises:

a wavelength-locking device (Fig. 10) coupled to the optical transmitters for locking a frequency separation of the optical signals to a predetermined value.

Regarding claim 29, Tsushima discloses:

The optical communications system of claim 22 further comprising:

a receiver subsystem coupled to the transmitter subsystem by an optical fiber, the receiver subsystem comprising:

an optical splitter (divider 16 in Fig. 9) for splitting the composite optical signals into multiple signals; and

a plurality of heterodyne receivers (receivers 3a-3c) coupled to the optical splitter for recovering information from the signals.

Regarding claim 50, claim 50 is a method claim that corresponds largely to the system claim 22. Therefore, the recited means in system claim 22 read on the corresponding steps in method claim 50. Claim 50 also includes limitations absent from claim 22. Tsushima also discloses these limitations:

transmitting the composite optical signal across an optical fiber (optical fiber 2).

Regarding claim 52, claim 52 is method claim that introduces limitations that correspond to the limitations introduced by system claim 27. Therefore, the recited means in system claim 27 read on the corresponding steps in method claim 52.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

> the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Tsushima et al. as primary reference

15. **Claims 1-6, 8, 10-11, 19-20, 38-39, 42, and 48** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima in view of Kitayama.

Regarding claim 1, Tsushima discloses:

An optical communications system comprising:

a transmitter subsystem (Figs. 1 and 4) comprising:

at least two optical transmitters (e.g., transmitters 4(n-1), 4n), each for generating an optical signal containing a subband of information; and

an optical combiner (photocoupler 5) coupled to the optical transmitters for optically combining the optical signals into a composite optical signal.

Tsushima does not expressly disclose:

each optical signal having a different polarization.

However, Kitayama does disclose an optical communications system comprising a transmitter subsystem, which also comprises at least two optical transmitters, each for generating an optical signal containing a subband of information, each optical signal having a different polarization (Fig. 9). At the time the invention was made, it would have been obvious to one of ordinary skill in the art to implement

the teachings of Kitayama to the system of Tsushima so that each optical signal has a different polarization. One of ordinary skill in the art would have been motivated to do this since introducing this polarization division multiplexing (PDM) teaching can increase the spectrum efficiency of the communications system (Kitayama, abstract). In particular, note that Tsushima teaches an optical frequency division multiplexing (OFDM) system and that Kitayama expressly teaches the application of PDM to an OFDM system (abstract).

Regarding claim 2, Tsushima in view of Kitayama discloses:

The optical communications system of claim 1 wherein the optical signals are orthogonally (Kitayama, Fig. 9, p. 974, col. 2, "mutually orthogonal") polarized.

Regarding claim 3, Tsushima in view of Kitayama discloses:

The optical communications system of claim 2 wherein:

each optical transmitter comprises:

an optical source (Tsushima, e.g., lasers in Fig. 4; Kitayama, cwLD#1, cwLD#2 in Fig. 3) for producing an optical carrier; and

an electro-optic modulator (Tsushima, e.g., modulators in Fig. 4; Kitayama, EOM#1, EOM#2) coupled to the optical source for modulating the optical carrier with the subband of information; and

at least one of the optical transmitters further comprises:

a polarization controller (Kitayama, PC) for making a polarization of the optical signal orthogonal to a polarization of the other optical signal.

Regarding claim 4, Tsushima in view of Kitayama discloses:

The optical communications system of claim 2 wherein:

at least one of the optical transmitter comprises:

a wavelength-tunable optical source (Tsushima, e.g., DFB-LDs 4a in Fig. 10), whereby a wavelength of the optical signal generated by the optical transmitter can be tuned by tuning the wavelength-tunable optical source; and

the optical filter comprises:

a comb filter having periodically spaced pass bands (Tsushima, e.g., periodicity in Figs. 3B, 5, and 7).

Regarding claim 5, Tsushima in view of Kitayama discloses:

The optical communications system of claim 1 wherein:

each optical signal (FSK version, Fig. 3A-3F) has a lower optical sideband and an upper optical sideband; and

each optical transmitter comprises:

an optical filter (e.g., optical filter 13(n-1) in Fig. 4) for selecting one optical sideband from the optical signal.

Regarding claim 6, Tsushima in view of Kitayama discloses:

The optical communications system of claim 1 wherein:

each optical signal (FSK version, Fig. 3A-3F) has a lower optical sideband and an upper optical sideband; and

the transmitter subsystem further comprises:

an optical filter (optical filter 6) coupled to the optical combiner for selecting one optical sideband from each optical signal.

Regarding claim 8, Tsushima in view of Kitayama discloses:

The optical communications system of claim 6 wherein the optical filter comprises:

a comb filter having periodically spaced pass bands (Tsushima, e.g., periodicity in Figs. 3B, 5, and 7).

Regarding claim 10, Tsushima in view of Kitayama discloses:

The optical communications system of claim 6 wherein the optical filter attenuates out-of-band wavelengths (optical filter 6 attenuates wavelengths that are out of the passbands).

Regarding claim 11, Tsushima in view of Kitayama discloses:

The optical communications system of claim 1 wherein the transmitter subsystem further comprises:

a wavelength-locking device (Fig. 10) coupled to the optical transmitters for locking a frequency separation of the optical signals to a predetermined value.

Regarding claim 19, Tsushima in view of Kitayama discloses:

The optical communications system of claim 1 further comprising:

a receiver subsystem (Tsushima, portion after optical fiber 2 in Fig. 9; Kitayama, portion after SMF in Fig. 3) coupled to the transmitter subsystem by an optical fiber for recovering the subbands from the composite optical signal.

Regarding claim 20, Tsushima in view of Kitayama discloses:

The optical communications system of claim 19 wherein the receiver subsystem comprises:

a polarizing splitter module (Kitayama, p. 974, col. 2, "polarization beam splitter") for splitting the composite optical signal according to polarization; and

a plurality of heterodyne receivers (Kitayama, PD#1, PD#2) coupled to the polarizing splitter module for recovering the subbands.

Regarding claim 38, claim 38 is a method claim that corresponds largely to the system claim 1. Therefore, the recited means in system claim 1 read on the corresponding steps in method claim 38. Claim 38 also includes limitations absent from claim 1. Tsushima in view of Kitayama also discloses these limitations:

transmitting the composite optical signal across an optical fiber (SMF in Fig. 3).

Regarding claims 39, 42, and 48, claims 39, 42, and 48 are method claims that introduce limitations that correspond to the limitations introduced by system claims 2, 11, and 20, respectively. Therefore, the recited means in system claims 2, 11, and 20 read on the corresponding steps in method claims 39, 42, and 48.

Claims 51 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima as applied to claim 50 above, and further in view of Kitayama.

Regarding claim 51, claim 51 introduces limitations that correspond to the limitations introduced by claim 2. Kitayama was applied to address these limitations of claim 2. Similarly, Kitayama is applied here to address the corresponding limitations in claim 51.

Regarding claim 54, claim 54 introduces limitations that correspond to the limitations introduced by claim 20. Kitayama was applied to address these limitations of claim 20. Similarly, Kitayama is applied here to address the corresponding limitations in claim 54.

16. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima in view of Kitayama as applied to the claims above, and further in view of Ramaswami et al. (*Optical Networks: A Practical Perspective*, hereinafter "Ramaswami") and Othonos ("Fiber Bragg gratings").

Regarding claim 7, Tsushima in view of Kitayama does not expressly disclose:

The optical communications system of claim 6 wherein the optical filter comprises two Bragg filters coupled in series.

However, Othonos does disclose an optical filter comprising multiple Bragg filters in series. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to substitute the arrangement employing the Fabry-Perot optical filter (Tsushima, col. 3, l. 67) of Tsushima in view of Kitayama with an arrangement employing the multiple Bragg filters of Othonos. The arrangement employing the multiple Bragg filters of Othonos would filter by reflection as opposed to filtering by transmission, as with the Fabry-Perot filter of Tsushima. One of ordinary skill in the art would have been motivated to do this since they both have similar comb-like functions (Tsushima, Fig. 3B; Othonos, Fig. 38), and since fiber Bragg gratings introduce advantages over other filtering devices, such as Fabry-Perot filters (Ramaswami, p. 102-106). Such advantages include low loss, easy of coupling (with other fibers), polarization insensitivity, low temperature coefficient, simple packaging, and low cost (Ramaswami, p. 99, 1st full paragraph).

17. **Claims 14-15 and 43-44** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima in view of Kitayama as applied to the claims above, and further in view of Watanabe et al. ("Optical coherent broad-band transmission for long-haul and distribution systems using subcarrier multiplexing," hereinafter "Watanabe") and Hill et al. (U.S. Patent No. 5,546,190, hereinafter "Hill").

Regarding claim 14, Tsushima in view of Kitayama does not expressly disclose:

The optical communications system of claim 1 wherein each optical transmitter includes:

at least two electrical transmitters for generating electrical channels;

an FDM multiplexer coupled to the electrical transmitters for FDM multiplexing the electrical channels into an electrical high-speed channel, the electrical high-speed channel further including a tone; and

an E/O converter coupled to the FDM multiplexer for converting the electrical high-speed channel into the optical signal.

However, Hill teaches these limitations (Fig. 2) of as part of a transmission technique called subcarrier multiplexing (SCM). At the time the invention was made, it would have been obvious to one of ordinary skill in the art to implement SCM with the OFDM system of Tsushima in view of Kitayama. One of ordinary skill in the art would have been motivated to do this since Watanabe teaches that combining SCM and OFDM is easy and permits one to transmit a vast amount of information through a single optical fiber (Watanabe, p. 116, col. 2, last full paragraph), presumably more information than one could transmit using either SCM or OFDM alone.

Regarding claim 15, Tsushima in view of Kitayama, Watanabe, and Hill discloses:

The optical communications system of claim 14 wherein the at least two optical transmitters comprise:

a first optical transmitter (Hill, Fig. 2) for generating a first optical signal containing at least two subbands and a tone (Fig. 4), at least one of the subbands including I and Q signals (I and Q signals in Fig. 2).

Tsushima in view of Kitayama, Watanabe, and Hill does not expressly disclose:

asynchronous I and Q signals.

However, asynchronous data signals are extremely well known throughout the communication arts. They are often contrasted to synchronous data signals. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ asynchronous I and Q signals. One of

ordinary skill in the art would have been motivated to do this since asynchronous data signals do not require the transmitting and receiving ends of the communication channel to synchronize before communicating data, thus leading to faster and simpler transmission of data.

Regarding claims 43-44, claims 43 and 44 are method claims that introduce limitations that correspond to the limitations introduced by system claims 14 and 15, respectively. Therefore, the recited means in system claims 14-15 read on the corresponding steps in method claims 43-44.

18. **Claims 16-21 and 45-49** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima in view of Kitayama, Watanabe, and Hill as applied to the claims above, and further in view of Ramaswami.

Regarding claim 16, Tsushima in view of Kitayama, Watanabe, and Hill does not expressly disclose:

The optical communications system of claim 15 wherein:

each of the asynchronous I and Q signals is based on a separate oC-48 signal; and

the subband including the asynchronous I and Q signals has a capacity of approximately 5.0 Gbps of information.

However, OC-48 signals are well known in the art as being part of the *optical channel* (OC) layer as defined by the International Telecommunications Union (Ramaswami, p. 284-285), a standard-making body in the field of telecommunications. OC-48 signals correspond to optical signals with the data rate of approximately 2.5 Gbps. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to base each of the I and Q signals of Tsushima in view of Kitayama, Watanabe, and Hill on separate OC-48 signals. One of ordinary skill in the art would have been motivated to do this so that one can interface this system of Tsushima in view of Kitayama, Watanabe, and Hill with other systems that already employ the ITU optical channel (OC) standard data rates. With the I and Q signals being based on OC-48 signals, the subband would have a capacity of approximately 5.0 Gbps of information (OC-48 + OC-48 = OC-96 ~ 5.0 Gbps).

Regarding claim 17, Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami discloses:

The optical communications system of claim 14 wherein the at least two optical transmitters comprise:

a first optical transmitter (e.g., Tsushima's transmitter 4(n-1) in view of Hill's Fig. 2) for generating a first optical signal containing at least two subbands and a tone (Hill, Fig. 4), each subband having a capacity of approximately 2.5Gbps of information (Ramaswami, see treatment of claim 16 above); and

a second optical transmitter (e.g., Tsushima's transmitter 4n in view of Hill's Fig. 2) for generating a second optical signal containing at least two subbands and a tone (Hill, Fig. 4), each subband having a capacity of approximately 2.5Gbps of information (Ramaswami, see treatment of claim 16 above), wherein the second optical signal is orthogonally polarized (Kitayama, Fig. 9) to the first optical signal.

Regarding claim 18, Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami discloses:

The optical communications system of claim 17 wherein:

the first optical signal (Tsushima, ASK version, col. 4, l. 63-66) has a lower optical sideband (Tsushima, e.g., lower half of band ch.(n-1) in Fig. 5A) and an upper optical sideband (Tsushima, e.g., upper half of band ch.(n-1) in Fig. 5A), each optical sideband containing the at least two subbands and tone (Hill, Fig. 4);

the second optical signal (Tsushima, ASK version, col. 4, l. 63-66) has a lower optical sideband (e.g., lower half of band ch.n in Fig. 5B) and an upper optical sideband (e.g., upper half of band ch.n in Fig. 5B), each optical sideband containing the at least two subbands and tone (Hill, Fig. 4); and

the transmitter subsystem further comprises:

an optical filter (Tsushima, optical filter 6) coupled to the optical combiner for passing the lower optical sideband of the first optical signal (optical filter 6 selects both sidebands of band ch.(n-1), including the lower optical sideband) and the upper optical sideband of the second optical signal (filter 6 selects both sidebands of band ch.n, including the upper optical sideband).

Regarding claim 19, Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami discloses:

The optical communications system of claim 1 further comprising:

a receiver subsystem (Tsushima, portion after optical fiber 2 in Fig. 9; Kitayama, portion after SMF in Fig. 3; Hill, portion after optical fiber 14 in Fig. 1) coupled to the transmitter subsystem by an optical fiber for recovering the subbands from the composite optical signal.

Regarding claim 20, Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami discloses:

The optical communications system of claim 19 wherein the receiver subsystem comprises:

a polarizing splitter module (Kitayama, p. 974, col. 2, "polarization beam splitter") for splitting the composite optical signal according to polarization; and

a plurality of heterodyne receivers (Kitayama, PD#1, PD#2; Hill, Fig. 1, col. 5, l. 30-31) coupled to the polarizing splitter module for recovering the subbands.

Regarding claim 21, Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami discloses:

The optical communications system of claim 19 wherein the receiver subsystem comprises:

an optical splitter module (Tsushima, divider 16 in Fig. 9) for splitting the composite optical signal; and

a plurality of heterodyne receivers (Tsushima, receivers 3a-3c in Fig. 9) coupled to the optical splitter module for recovering the subbands, wherein at least one heterodyne receiver comprises:

> a polarization controller (Hill, polarization controller 26) for matching a polarization of an optical local oscillator signal for the heterodyne receiver and a polarization of a tone in a portion of the composite optical signal received by the heterodyne receiver.

Regarding claims 45-46, claims 45 and 46 are method claims that introduce limitations that correspond to the limitations introduced by system claims 16 and 17, respectively. Therefore, the recited means in system claims 16-17 read on the corresponding steps in method claims 45-46.

Regarding claim 47, claim 47 is a method claim that corresponds largely to the system claim 18. Therefore, the recited means in system claim 18 read on the corresponding steps in method claim 47.

Claim 47 also includes limitations absent from claim 18. Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami also discloses these limitations:

optically combining the optical signals so that a lower optical sideband (Tsushima, e.g., the lower half of band ch.n in Figs. 5B and 5D) of the first optical signal is adjacent to an upper optical sideband of the second optical signal (Tsushima, e.g., the upper half of band ch.(n-1) in Figs. 5A and 5D).

Regarding claim 48, claim 48 is a method claim that introduces limitations that correspond to the limitations introduced by system claim 20. Therefore, the recited means in system claim 20 read on the corresponding steps in method claim 48.

Regarding claim 49, claim 49 is a method claim that corresponds largely to the system claim 21. Therefore, the recited means in system claim 21 read on the corresponding steps in method claim 49. Claim 49 also includes limitations absent from claim 21. Tsushima in view of Kitayama, Watanabe, Hill, and Ramaswami also discloses these limitations:

mixing (Hill, col. 5, l. 21-29) the pilot tone and the polarization-matched signal.

19. **Claim 24** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima as applied to claim 22 above, and further in view of Othonos.

Regarding claim 24, claim 24 introduces limitations that correspond to the limitations introduced by claim 7. Othonos were applied to address these limitations of claim 7. Similarly, Othonos is applied here to address the corresponding limitations in claim 24.

20. **Claims 28 and 53** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsushima as applied to claim 22 above, and further in view of Watanabe and Hill.

Regarding claim 28, claim 28 introduces limitations that correspond to the limitations introduced by claim 14. Watanabe and Hill were applied to address these limitations of claim 14. Similarly, Watanabe and Hill are applied here to address the corresponding limitations in claim 28.

Regarding claim 53, claim 53 is a method claim that introduces limitations that correspond to the limitations introduced by system claim 28. Therefore, the recited means in system claim 28 read on the corresponding steps in method claim 53.

Allowable Subject Matter

21. **Claims 9, 12-13, and 40-41** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Taga et al. is cited to show related apparatuses and methods that transmit alternating WDM channels with orthogonal polarizations. Pan is cited to show related apparatuses and methods that transmit WDM channels with orthogonal PDM and receive with polarization splitters. Atlas is cited to show related apparatuses and methods that transmit WDM channels with orthogonal polarizations for reducing Raman crosstalk. Bergano et al. '961 is cited to show related apparatuses and methods that transmit alternating WDM channels with orthogonal polarizations. Bergano '515 is cited to show related apparatuses and methods that transmit alternating WDM channels with orthogonal polarizations. Schoenfelder is cited to related apparatuses and methods that transmit two optical signals of the same wavelength with orthogonal polarizations. Suga et al. is cited to show related apparatuses and methods that employ optical comb filters to transmit alternating WDM channels with orthogonal polarizations.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Kim whose telephone number is 571-272-3033. The examiner can normally be reached on Mon.-Fri. 9 AM to 5 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571-272-3022. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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DSK

JASON CHAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600